

CLAIMS

1. A method for preparing an ester condensate, wherein an esterification reaction is carried out using a catalyst containing a zirconium (IV) compound and/or a hafnium(IV) compound and an iron(III) compound and/or a gallium(III) compound.

2. The method for preparing an ester condensate according to claim 1, wherein the zirconium (IV) compound is a compound represented by a general formula (1):



(wherein, R^1 represents an acyl group or an alkyl group, and each of a and b is 0 or any one of integers of 1 to 4 and the relationship of $a + b = 4$ is satisfied).

3. The method for preparing an ester condensate according to claim 1, wherein the zirconium (IV) compound is a compound represented by a general formula (3):



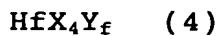
(wherein X represents a halogen atom, Y represents tetrahydrofuran, and e represents 0 or 2).

4. The method for preparing an ester condensate according to claim 1, wherein the hafnium (IV) compound is a compound represented by a general formula (2):



(wherein, R^2 represents an acyl group or an alkyl group, and each of c and d is 0 or any one of integers of 1 to 4 and the relationship of $c + d = 4$ is satisfied).

5. The method for preparing an ester condensate according to claim 1, wherein the hafnium (IV) compound is a compound represented by a general formula (4):



(wherein X represents a halogen atom, Y represents tetrahydrofuran, and f represents 0 or 2).

6. The method for preparing an ester condensate according to any one of claims 1 to 5, wherein the iron compound is iron(III) alkoxide, and the gallium compound is gallium(III) alkoxide.

7. The method for preparing an ester condensate according to any one of claims 1 to 6, wherein the abundance of the iron compound is 5 mol% or more in relation to the zirconium (IV) compound and/or the hafnium (IV) compound.

8. The method for preparing an ester condensate according to any one of claims 1 to 7, wherein the esterification reaction is carried out by heating to reflux with a solvent, and removing azeotropic water from a reaction system.

9. The method for preparing an ester condensate according to claim 8, wherein a nonpolar or a low-polar solvent is used as the solvent.

10. The method for preparing an ester condensate according to claim 9, wherein the nonpolar or the low-polar solvent is one or more of solvents selected from the group of toluene, xylene, mesitylene, or anisole.

11. The method for preparing an ester condensate according to any one of claims 1 to 10, wherein an ionic liquid is added to the reaction system after the esterification reaction is finished, ester is obtained from an organic layer, and then an ionic liquid layer per se is used as a catalytic solution.
12. The method for preparing an ester condensate according to claim 11, wherein the ionic liquid is 1-butyl-3-methyl imidazolium trifluoromethanesulfonimide, 1-ethyl-3-methylimidazolium trifluoromethanesulfonate.
13. The method for preparing an ester condensate according to claim 11, wherein the ionic liquid is N-alkylpyridinium trifluoromethane sulfonate imide.
14. The method for preparing an ester condensate according to any one of claims 1 to 10, wherein a hydrochloric acid aqueous solution is added to the reaction system after the esterification reaction is finished, ester is obtained from an organic layer, and then an aqueous layer per se is used as a catalytic solution.
15. The method for preparing an ester condensate according to any one of claims 11 to 14, wherein the low-polar organic solvent such as toluene and heptane is used as the solvent.
16. The method for preparing an ester condensate according to any one of claims 1 to 15, wherein the esterification reaction is a reaction of carboxylic acid and alcohol.

17. A catalyst for preparing an ester condensate, which is used in the esterification reaction and which contains a zirconium (IV) compound and/or a hafnium (IV) compound, and an iron compound and/or a gallium compound.

18. The catalyst for preparing an ester condensate according to claim 17, wherein the zirconium (IV) compound is a compound represented by a general formula (1):



(wherein, R^1 represents an acyl group or an alkyl group, and each of a and b is 0 or any one of integers of 1 to 4 and the relationship of $a + b = 4$ is satisfied).

19. The catalyst for preparing an ester condensate according to claim 17, wherein the zirconium (IV) compound is a compound represented by a general formula (3):



(wherein X represents a halogen atom, Y represents tetrahydrofuran, and e represents 0 or 2).

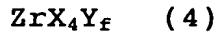
20. The catalyst for preparing an ester condensate according to claim 17, wherein the hafnium (IV) compound is a compound represented by a general formula (2):



(wherein, R^2 represents an acyl group or an alkyl group, and each of c and d is 0 or any one of integers of 1 to 4 and the relationship of $c + d = 4$ is satisfied).

21. The catalyst for preparing an ester condensate according to claim 17, wherein the hafnium (IV) compound is a compound

represented by a general formula (4):



(wherein X represents a halogen atom, Y represents tetrahydrofuran, and f represents 0 or 2).

22. The catalyst for preparing an ester condensate according to any one of claims 17 to 21, wherein the iron compound is iron(III) alkoxide, and the gallium compound is gallium(III) alkoxide.

23. The catalyst for preparing an ester condensate according to any one of claims 17 to 22, wherein an abundance of the iron compound is 5 mol% or more in relation to the zirconium (IV) compound and/or the hafnium (IV) compound.

24. The catalyst for preparing an ester condensate according to any one of claims 17 to 23, wherein an ionic liquid is added to the reaction system after the esterification reaction is finished, ester is obtained from an organic layer, and then an ionic liquid layer per se is used.

25. The catalyst for preparing an ester condensate according to claim 24, wherein the ionic liquid is 1-butyl-3-methyl imidazolium trifluoromethanesulfonimide, 1-ethyl-3-methylimidazolium trifluoromethanesulfonate.

26. The catalyst for preparing an ester condensate according to claim 24, wherein the ionic liquid is N-alkylpyridinium trifluoromethane sulfonate imide.

27. The catalyst for preparing an ester condensate according to any one of claims 17 to 23, wherein a hydrochloric acid aqueous solution is added to the reaction system after the esterification reaction is finished, ester is obtained from an organic layer, and then an aqueous layer per se is used as a catalytic solution.

28. The catalyst for preparing an ester condensate according to any one of claims 17 to 27, wherein the esterification reaction is a reaction of carboxylic acid and alcohol.